REMARKS

By the above actions, claims 1 and 5 have been amended and claim 2 has been canceled (and incorporated into claim 1). In light of the above amendments and for the reasons set forth below, further consideration of this application is now requested.

With regard to the Examiner's rejections of claims 1, 2 and 5, under §102(a), as being anticipated by the teachings of Stengl et al. ('062) and claims 3, 4 and 6, under §103(a), as being obvious in view of the teachings of Stengl et al. ('062) combined with Muraki ('725), the rejections are considered to be inappropriate for the following reasons.

Initially, the Applicants note that the instant claim 1 recites the following features:

> an electron beam source which emits an electron beam;
>
> an electron beam shaping device which shapes the electron beam;
>
> a mask which has an aperture and is disposed on a path of the shaped electron beam;
>
> a deflecting and scanning device which deflects the electron beam to scan the mask with the shaped electron beam;
>
> a blanker electrode and a blanking aperture which take on-off control of emission of the electron beam; and
>
> a stage which holds and moves an object,
>
> wherein the mask is disposed in proximity to a surface of the object, and ~~a~~ patterns corresponding to the aperture of the mask exposed on the surface of the object with the electron beam having passed through the aperture,
>
> wherein the electron beam shaping device comprises an electrostatic cylindrical lens which has power in a single direction which shapes the electron beam into a slender beam of which cross section has a small width in a direction of the scanning and a large width in a direction perpendicular to the direction of the scanning. (Emphasis Added)

The Examiner in rejecting claim 1 over the teachings of Stengl et al states, in the final Office Action, that the patentees teach:

> an electron beam exposure apparatus and associated method of use comprising an electron source (Q and Col. 2 Lines 53-57), an electron beam shaping means comprising an electrostatic cylindrical lens (Elsubi through Elsubn in Fig. 2 and Col. 2 Lines 31-36) as recited in claim 2, a mask having a plurality of apertures (M) in proximity to a sample, a deflecting and scanning means (Fig. 4 and Fig. 5 Item MP Col. 8 Lines 54-Col. 9 Line 9), a stage (S), where the beam is shaped to have a cross section in the plane of the sample which is smaller that the cross section in a plane extending vertically and perpendicular

> from the sample (Col. 8 Lines 54-Col. 9 Line 9) as recited in claims 1, 2, and 5.
>
> Stengl et al. further teaches blanking electrodes in the form of multipole MP and a blanking aperture (Bs) which is capable of selectively screening out all or a portion of a beam (Col. 10 Line 61 — Col. 11 Line 4) (Emphasis Added)

and further states Stengl et al teach:

> the blanking device claimed by the Applicant as noted above. Regarding the beam shaping means, this limitation is taught by Stengl et al. at the end of Col. 8 and the beginning of Col. 9 where it is clearly taught that the operation of the multipole manipulates beam size and cross-sectional shape, as well as scan. Fig. 5 points out that there may be any number of multipoles present to conform the scan and beam profile to any of a number of conformations taught by Stengl et al., the most relevant one being a rectangle, a shape taught by Stengl et al., where the rectangle is scanned across the surface of the substrate with the smaller sides running parallel to the direction of scanning. (Emphasis Added)

These comments clearly illustrate that the invention of claim 1 as presently claimed is not met by the teachings of Stengl et al. Initially, the Examiner states that the "Elsubi through Elsubn" comprises the beam shaping means as claimed. However, this is not correct since the ring (column 6, lines 30-32) or hollow cylindrical (column 7, lines 7-22) electrodes $El_{-...n}$ are clearly stated to form a uniform (homogeneous) electrostatic field E which shapes the beam emerging from the crossover Q' point by increasing the field intensity progressively toward the substrate (column 6, lines 30-57; column 8, lines 31-40). (Compare the ring or hollow cylindrical lens of Stengl with the lens of the instant application at Figures 6A (X-direction section) and 6B (Y-direction section).) For ring or hollow cylinder of Stengl et al to perform the described function, the rings or cylinder must exert power in all radial directions and not "in a single direction" as presently claimed. Further, the Examiner later states that the multipoles MP (instead of rings $El_{-...n}$) have the ability to shape the beam as well as deflect (scan) the beam over the substrate (column 8, line 54, to column 9, line 9; Figures 4 or 5). However, this assertion also does not meet the claimed limitation of providing an "electron beam shaping device comprises an electrostatic cylindrical lens which has power in a single direction" since as stated by Stengl et al the multipole effects displacement of the beam in both the X- and Y-directions to deflect and shape the beam.

Still further, the Examiner states that Stengl et al. teach "blanking electrodes in

the form of multipole MP and a blanking aperture (Bs) which is capable of selectively screening out all or a portion of a beam... the blanking device claimed by the Applicant as noted above." That is, the multipoles MP of Stengl et al now have a third function, i.e., that of a blanking electrode; which in conjunction with the aperture plate B_s can screen out all or part of the beam (column 10, line 61, to column 11, line 3). However, a detailed reading of the Stengl et al. does not reveal a single teaching or inference that the multipole MP serves the function of a blanking electrode. That is, as the Examiner is aware, a blanking electrode must apply sufficient voltage to form an electric field of an intensity sufficient to deflect the beam completely out of the opening of the aperture formed in the aperture plate. The Stengl et al. patent contains no such teaching or suggestion. Instead, the multipoles MP are only taught to perform a single scan over a mask to expose a substrate utilizing of a beam width which is equal the image field, i.e., 200mm (see Figures 4, 5; Tables 1 and 2). In contrast to a blanker electrode and blanker aperture, Stengl et al teach a shutter plate B_s which through its geometry alone can be used to effect blockage of the beam. Therefore, the teachings of Stengl et al do not teach an electron beam shaping device, a deflection and scanning device and a blanker electrode and blanking aperture as presently set forth either in claim 1 or claim 5.

For these reasons, the rejection of claims 1, 2 and 5, under § 102(b), as being anticipated by the teachings of Stengl et al. cannot be maintained and must now be withdrawn.

Turning to the combination of teachings of Stengl et al. and Muraki, as noted above the process and apparatus of Stengl is for scanning a beam in a single pass over a mask positioned above a substrate to expose selected portions of the substrate. However, a detailed reading of the Muraki reference reveals that the patentee discloses an improved electron beam exposure apparatus for controlled writing (exposing) of an electron beam resist placed upon the substrate. The patentee teaches (Figure 13, 14A, 14B; column 1, line 23, to column 2, line 15) that the prior art methods/apparatus of writing for electron beam resists have deficiencies in the detail of the writing caused by electron scattering at higher acceleration voltages. To overcome this problem, the patentee teaches an electron beam exposure

method/apparatus which employs a deviation detection means to detect deviation between irradiation of a resist at a first acceleration voltage and a second acceleration voltage, a positional relationship detecting means to detect a relationship between and object to be exposed and the irradiated position of the electron beam, and calculating means for calculating the position of an object to be exposed and the position of the electron beam (column 2, lines 23-49). This improved exposure method/apparatus enables repeated exposure of multiple sub-fields with little of the distortion problem faced by the prior art of electron beam writing. In contrast to Muraki, Stengl et al. teach a method and apparatus for exposure of a single pattern with a single scan through a mask onto a substrate (bearing a resist). Such a process is not an electron beam writing process as in Muraki (in which no mask is used to scan multiple times for a multitude of sub-fields onto a substrate). Therefore, due to the dissimilarities of the problems solved and the inventive processes/apparatus of Stengl et al and Muraki, one of ordinary skill in the prior art would not have been provided any motivation to modify the teachings of Stengl as asserted by the Examiner to perform multiple scanning in which the shape of the beam and the scanning width is as presently set forth in claims 3, 4 and 6. Quite simply, there is nothing in Stengl et al. to suggest the need for multiple scans of multiple sub-fields to solve the problems faced by Stengl et al. and the technology of Stengl et al does not encounter the same distortion problems caused by high acceleration voltages of an electron beam writing process as discussed in Muraki. Therefore, the Examiner's assertion that:

> It would have been obvious to one having ordinary skill in the art at the time the invention was made to provide an interval between scanning regions or pattern elements on a substrate for exposure in a multiple pass electron beam lithography device because, not only are these limitations taught by Muraki et al., but the configuration of pattern elements to be exposed and the amount of scans required by an electron beam are a function of the pattern, chosen by the practitioner of the invention. For example, one could select a pattern having any amount of desired space within a given pattern for exposure, such as in a SEM metrology standard where a plurality of raised lines are scribed into a substrate with differing distances between said lines. Secondly, the exposing of a pattern multiple times could be a function of reducing proximity effect, the depth and complexity of the pattern to be exposed, or the size and number of partitions in a total pattern selected to be exposed. The recited limitations are taught by Muraki et al. as cited above. (Emphasis Added)

is not based upon any teaching or suggestion provided by the references. The

Examiner's speculation that one of ordinary skill in the prior art "could select" a pattern of multiple scans and "could select" any pattern within a given space for the mask scanning process of Stengl et al. is not based upon any teaching or motivation within the references cited and only is prompted by the Applicants' teachings in the instant specification.

Since neither Stengl nor Muraki, alone or in combination, teach (or suggest) all features of the claimed invention, the rejection of claims 3, 4 and 6, under § 103(a), respectively, is also improper and should be withdrawn.

It is noted that a separate Extension of Time Petition (two months) accompanies this response along with authorization to charge the requisite extension of time fee. However, should that petition become separated from this Amendment, then this Amendment should be construed as containing such a petition. Likewise, any overage or shortage in the required payment should be applied to Deposit Account No. 19-2380 (740107-140).

While the present application is believed to be in condition for allowance, should the Examiner find some issue to remain unresolved, or should any new issues arise, which could be eliminated through discussions with Applicants' representative, then the Examiner is invited to contact the undersigned by telephone in order that the further prosecution of this application can thereby be expedited.

Respectfully submitted,

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